Appendix F: Segmental Alternative – Construction Methods

This document is provided for informational purposes only. The Design-Build Proposer shall not rely on this information in the preparation of a project Proposal. Please refer to the project’s Request for Proposal (RFP) for the final project requirements.
1.0 Available Methods of Construction for the Span-by-Span Segmental Alternative

There are two common methods used to erect precast segmental box structures. The first method is cantilever construction, wherein the segments are erected in a cantilevered sequence from each pier and then jointed at mid span. The second method is span-by-span, wherein the segments for an entire span are erected in place and then post tensioned together. It has been found that the span by span method is typically faster and hence more economical than cantilever construction, particularly for the span range being considered for the approaches to the Kosciuszko Bridge.

There are several methods available for span-by-span construction. The segments may be supported on temporary shoring, under-slung trusses, or from over-head gantries; before they are post-tensioned together to form a self supporting unit. Figures 1.1 through 1.3 illustrate these basic systems.

Figure 1.1 – Temporary Shoring

Figure 1.2-a – Self-launching Under-Slung Trusses
Figure 1.2-b – Short Under-Slung Trusses

Temporary Shoring Method

This is one of the most cost effective methods for erecting span-by-span if the conditions are right. The shoring is typically of standardized modules for economical fabrication and repeated usage over the length of the project. This is why this method is most suitable for low and level viaduct structures over grounds that are relatively open and level. Frequent crane moment is required for relocating the shoring, which makes the method more effective in an open field. For the Kosciuszko Bridge, the pier heights vary from 20’ to 80’, the approach crosses numerous streets and facilities that make placement of shoring challenging. Also the relatively narrow “pathway” between the existing and new superstructures would also make crane movements difficult if not impossible. For these reasons, the temporary shoring method is not considered to be a likely choice of construction method for this project.

Under-Slung Trusses

Under-slung trusses are typically supported on brackets mounted at the piers (Figure 1.2-a) or temporary bents supported off the permanent footings (Figure 1.2-b). The trusses can be designed to be self-launching and equipped with launching noses (Figure 1.2-a) or to be short...
and light-weight for relocating with the aid of a crane (Figure 1.2-b). The under-slung trusses depicted in Figures 1.2-a and 1.2-b support the superstructure segments near the juncture where the flange overhangs meets the webs (see Figure 2); this type of trusses reduces potential encroachment into traffic windows of crossing facilities beneath. For the Kosciuszko Approaches, the use of short under-slung trusses will be challenging because crane access to one of the trusses will be limited once the second of the two box section is placed (see Figure 3). The use of the longer self-launching trusses is a possibility, because the lowering of the “trapped” truss will be infrequent which makes it worth considering.

Self-launching under-slung trusses are often outfitted with a segment loader that will take segments that are fed to the work front via the completed portion of the structure and place them onto the trusses. Since there is water access on the Newtown Creek, erection of the precast segment can begin from the water side of the approaches and thus eliminate most if not all intermediate crane movements. In view of the relative economy of this method, the under-slung trusses should not be ruled out at this time.

![Figure 2](image-url)
Overhead Gantry

In comparison to the under-slung trusses, the overhead gantry is slightly more elaborate in design and in its operations. The size and configuration of the gantry does vary according to the constraints of each project. The cycle time for erecting a span with an overhead gantry is slightly longer than that needed using under-slung trusses. However, there are many factors that drive the overall cost and schedule and, historically, overhead gantries have been used on long approaches in spite of the marginally longer cycle time. A noteworthy feature of the overhead gantry is that the trolley and winch, typically outfitted on an overhead gantry, will replace the crane. Segments can either be delivered on the ground to one point of pick underneath the gantry (Figure 4) or to the rear of the gantry if ground delivery is not feasible for any reason (Figure 5). Ground delivery will of course require much less effort but is less likely for this project due to the congested site.
2.0 Choice of Construction Method

In case of the Kosciuszko Approaches, the critical path is likely to fall on the main span structure and not on the erection of the approach superstructures. The deciding factor on the type of equipment for erecting precast segment is expected to be the relative costs of regional field labor vs. greater investment in more efficient equipment such as the overhead gantry. Although the cycle time is marginally greater for the overhead gantry, the relative ease of advancing the equipment from span to span, and especially for the overhead gantry to laterally relocate from one line of girder to an adjacent line by lateral launching (or sometimes called side launching) (see Figure 6) would make the overhead gantry the logical first choice for considering in the design process.
2.0 Overall Erection Scheme

As design of all elements (including the connectors and ramps) of the project advances, a more complete assessment of durations and logical sequence of events can be confirmed. At this time, and looking strictly in terms of construction durations for the approaches and the main spans, there seems to be ample time to use just one erection gantry to complete the approach spans for each of the two contracts that involve the approaches (or the entire project if there were only one contract). If the entire approach were to be built at one time, Figure 7 shows a possible scenario for Stage 2 construction, based on ground delivery of segments to an overhead gantry, where erection starts adjacent to Newtown Creek, progresses toward Proposed Pier 17, side launches at Pier 17, and then works back toward Newtown Creek again. Figure 8 shows a recent example (the Roslyn Viaduct, Roslyn, New York) where an overhead gantry was assembled and reassembled in large sections; nevertheless, it should not be precluded that the contractor would propose launching the gantry over the Newtown Creek, with temporary bent supports, to avoid dis/re-assembling the gantry. Once landed on the Queens side, the same method employed on the Brooklyn side will be repeated, with side launching at Proposed Pier 36, and returning to the eastern edge of Newtown Creek.

The general process described above can be repeated for Stage 6 (westbound approach) construction. Depending on how the contracts are awarded, special arrangements may be made to acquire the erection gantry employed in Stage 2 construction, and maintain it for use in Stage 6.
Figure 7
Figure 8